Build4 Scale
U.S. Department of Energy

Beta Prototype and Test Plan

Module 4D Refinement of Design

Motivation

Why is this module important?

- Almost any final product goes through an iterative process called the product development cycle
- Prototype development and testing is a crucial building block in the product development cycle
- Successive iterations typically include many changes to design, function, or specifications
- Failing to properly document these changes can result in a final design or product that does not satisfy the desired requirements

Module Outline

- Learning objectives
- Documenting the prototype development cycle
  - —What to document?
  - —How to document?
- Next step: toward scaling up
  - —Key aspects to capture from the prototyping cycle
  - —Beta testing

Learning Objectives

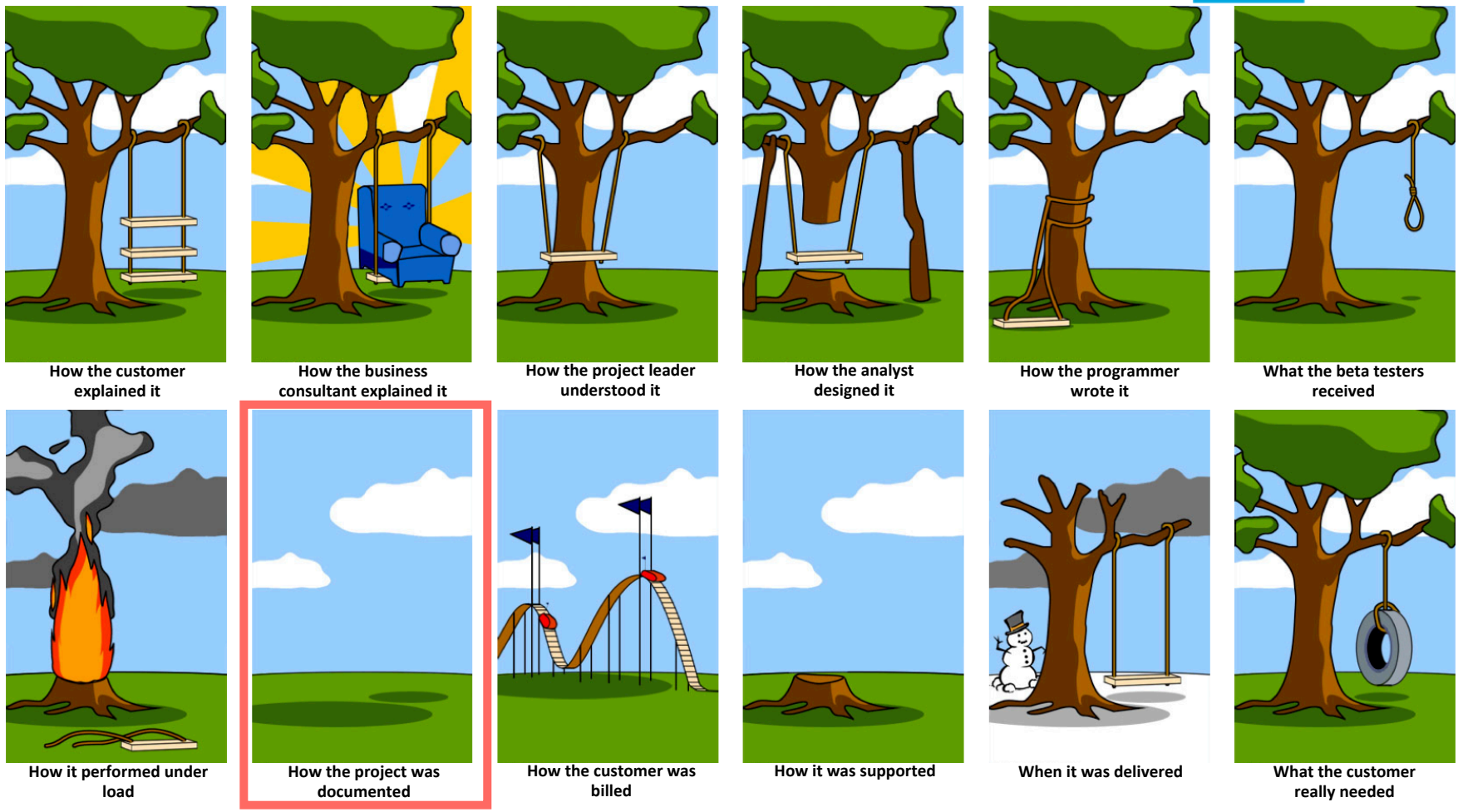
- LO1. Estimate the implication of design changes
- LO2. Document the design change process

What This Module Addresses

- The importance of documenting the product-development process
- The roles of change management and engineering change notices in documenting product development
- Best practices included in data management plans

Product Development Cycle

Importance of documentation



Source: http://projectcartoon.com/
7/19/11 chrisdouglas.com

Change Management Process

Basics

- The process of requesting, planning, implementing, and evaluating changes to the product
- Deals with managing the changes that occur between successive iterations in the product development cycle

Important acronyms: (Defined on following pages or go to glossary)

- **Engineering change request** (ECR)
- **Engineering change management** (ECM)
- **Engineering change notice** (ECN)
- **Engineering change order** (ECO)

Engineering Change Notice

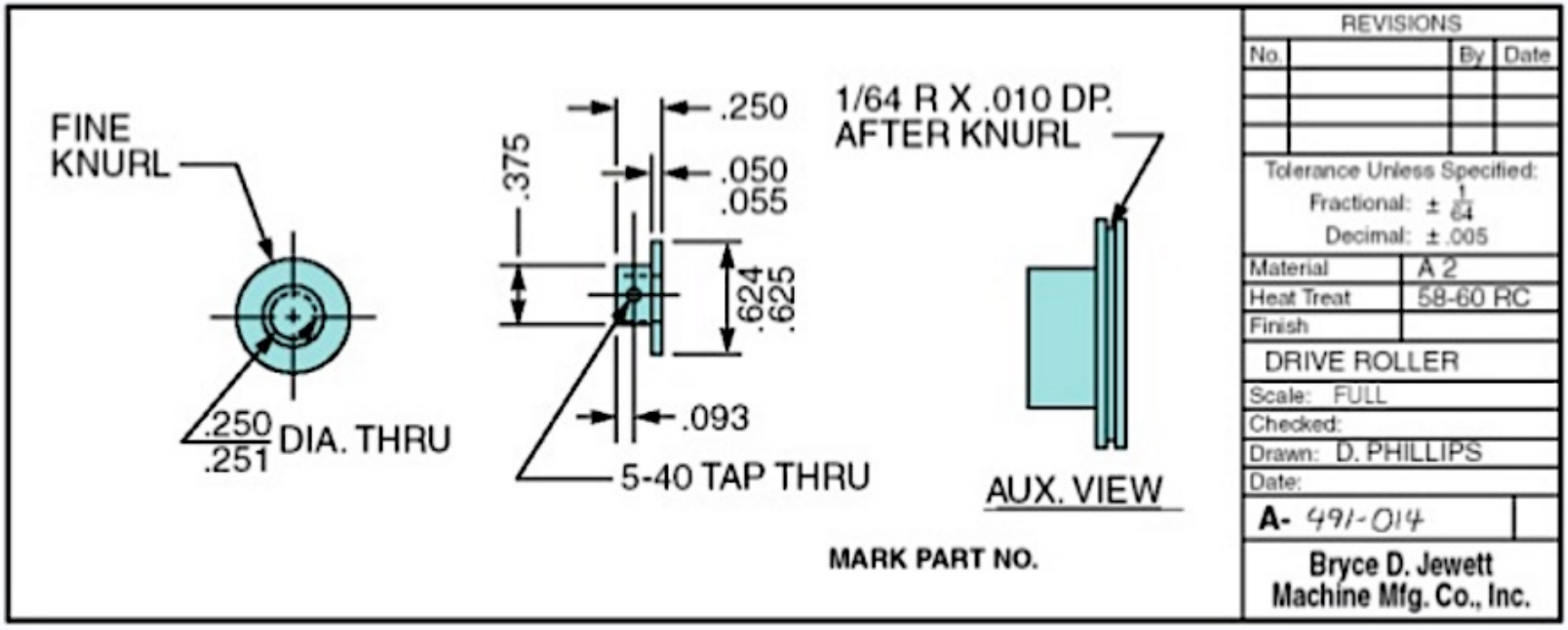
What it is and when to use it

- The **engineering change notice** (ECN) is a form that communicates the details of an approved change to stakeholders in the process
- The ECN is an essential part of the change management and product development processes
- A detailed description and an explanation of the change should be captured on the ECN form

Product Development Cycle

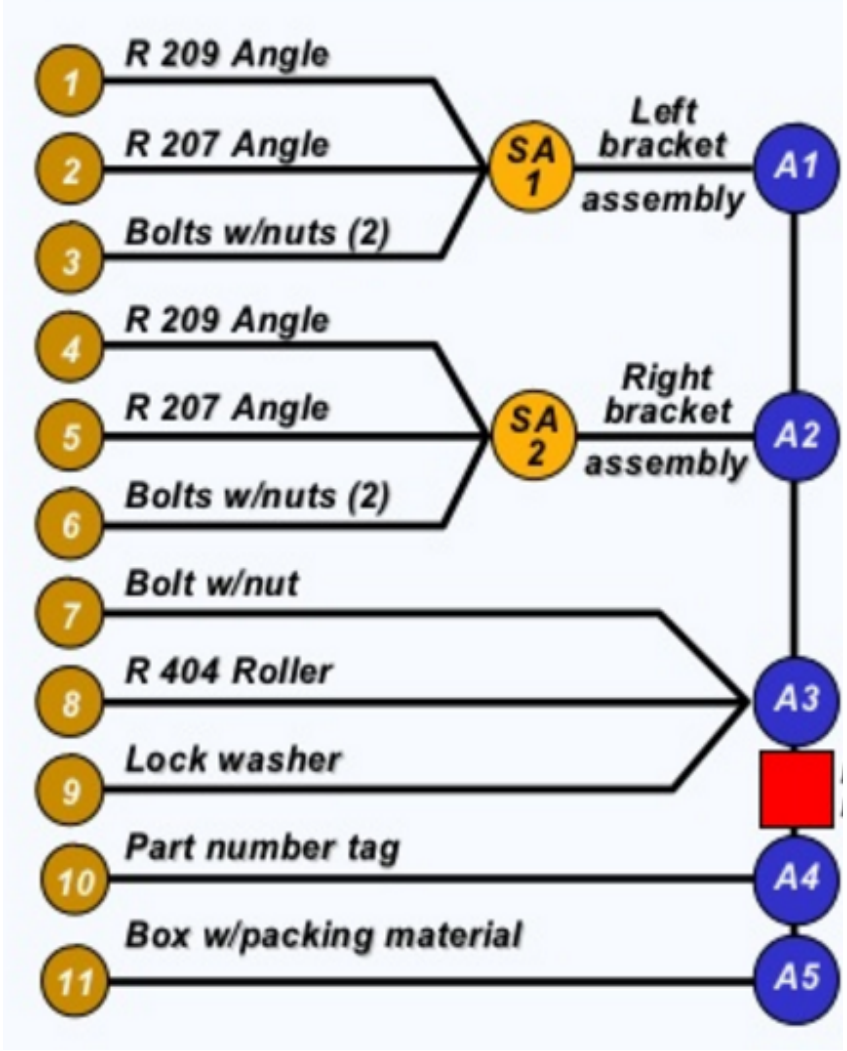
Example - Documenting ECN

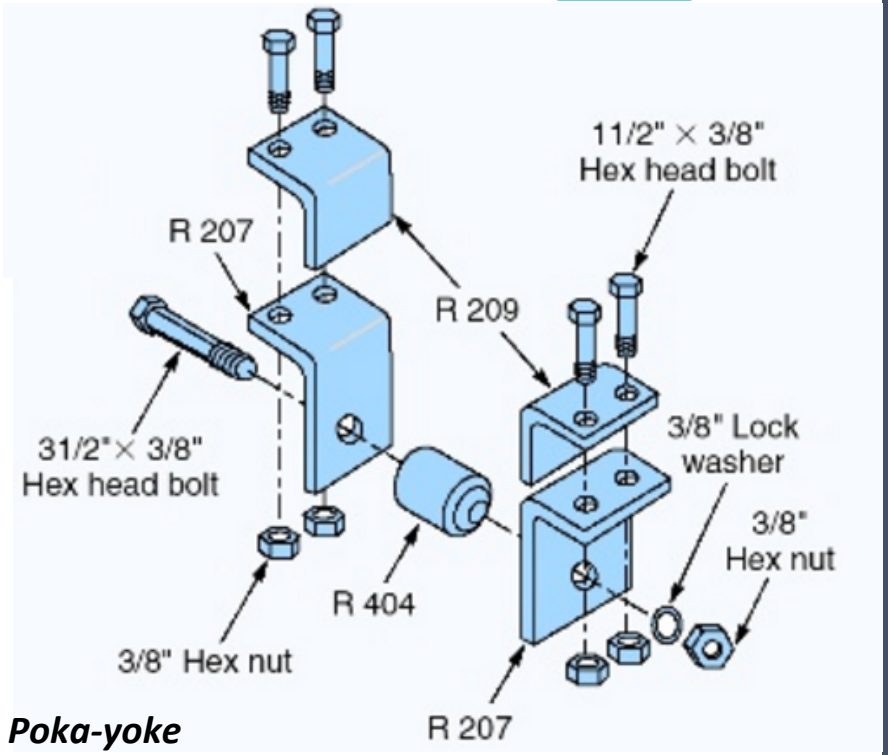
- At each iteration of the product development cycle, there is a need to document engineering drawings showing dimensions, tolerances, materials, and assembly



Product Development Cycle

Example - Documenting ECN (cont.)





Poka-yoke inspection

Product Development Cycle

Example - Documenting ECN (cont.)

- At each iteration, there is a need to document BOMs showing product structure and listing components and quantities

ITEM NO.	PART NUMBER	PART NAME	DESCRIPTION	SOURCE	QTY.
1	UCP21-AST	PILLOW BLOCK BEARING	AST - METRIC SERIES	PURCHASED	1
2	3GAA103001-BSE	ELECTRIC MOTOR 1.5KW	ABB - M2AA100L 6	PURCHASED	1
3	7493251	BASE FRAME	MACHINED	FABRICATED	1
4	7493250	BEARING MOUNTING PAD	MACHINED	FABRICATED	1
5	91292A241	SOCKET HEAD SCREWS	MCMASTER-CARR	PURCHASED	2
6	7493252	MOTOR SHAFT	HARDENED STEEL MACHINED	PURCHASED	1
7	91292A274	SOCKET HEAD SCREWS	MCMASTER-CARR	PURCHASED	4
8	7493254	MOTOR MOUNTING PAD	MACHINED	FABRICATED	1

Product Development Cycle

Documenting ECN

ECN can be documented in either of the following ways:

- **On paper**: works for simple products, but becomes complicated for more complex products with multiple design iterations and changes in their development cycles

Example: ECN ISO Template QP1110-1

- **Electronically or cloud-based**: enables change information to be documented effectively (notifications can be sent automatically to all stakeholders, including those across the supply-chain and inside the company)

Example: Arena Cloud-based ECN System

Data Management Plans

Basics

- Formal documents that outline how data are to be handled during a project (i.e., product development) and after the project is completed

Important questions to ask concerning data management plans (DMP) best practices:

- What types of data will be collected?
- In what format will the data be stored?
- How will the data be made understandable to future users?
- What policies and procedures guide data sharing?
- How will the data be archived and protected, and for how long?

Toward Scaling-Up

Next steps

Key aspects to capture from the prototype development cycle toward scaling up:

- Main failure modes
- Failure time distributions
- Critical design-change requirements
- Accurate assessment of cost for the scaled-up product based on experience and insight during the prototype development process

Toward Scaling-Up

Next steps (cont.)

Beta testing:

- Roll-out prototype for client/customer testing
- Design and implement questionnaires and surveys for design improvement
- Document results to feedback into the final design iteration

Glossary

Module 4D

Engineering Change Request (ECR) form is used to describe a suggested enhancement or problem with a product. The form initiates the change process — it promotes discussions within the organization to help determine the impact of a change and the best possible solution.

Engineering Change Management (ECM) is change management process in systems engineering is the process of requesting, determining attainability, planning, implementing, and evaluating of changes to a system.

Engineering Change Notice (ECN) is a document which records or authorizes a change to a specific design. The reasons for the change should also be recorded.

Engineering Change Orders (ECO) is used for changes in components, assemblies, or documents such as processes and work instructions. They may also be used for changes in specifications.

Data management Plan (DMP) is a formal document that outlines how data are to be handled both during a research project, and after the project is completed